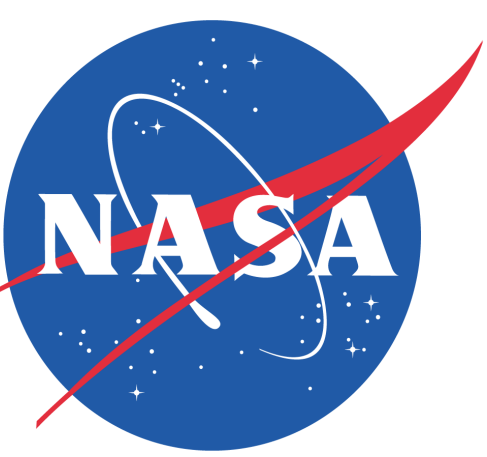


Temperature and Humidity Profiles in the “TqJoint” Data Group of AIRS Version 6 Product for the Climate Model Evaluation

AGU Fall Meeting, San Francisco, CA

Dec 15– 19, 2014

A43F-3337



NASA/Goddard EARTH SCIENCES DATA and INFORMATION SERVICES CENTER (GES DISC)

Research and operational communities are invited to take advantage of the improvements in AIRS Version 6 products and enjoy various services at GES DISC. <http://disc.sci.gsfc.nasa.gov/AIRS>

Feng Ding^{1,2}, Fan Fang^{1,2}, Thomas J. Hearty^{1,2}, Michael Theobald^{1,2}, Bruce Vollmer¹, Christopher Lynnes¹

¹NASA Goddard Space Flight Center, ²NASA Goddard Space Flight Center/SESDA

ABSTRACT

The Atmospheric Infrared Sounder (AIRS) mission is entering its 13th year of global observations of the atmospheric state, including temperature and humidity profiles, outgoing longwave radiation, cloud properties, and trace gases. Thus AIRS data have been widely used, among other things, for short-term climate research and observational component for model evaluation. One instance is the fifth phase of the Coupled Model Intercomparison Project (CMIP5) which uses AIRS version 5 data (Tian et al. 2013) in the climate model evaluation. The NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) is the home of processing, archiving, and distribution services for data from the AIRS mission. The GES DISC, in collaboration with the AIRS Project, released data from the version 6 algorithm in early 2013. The new algorithm represents a significant improvement over previous versions in terms of greater stability, yield, and quality of products.

The ongoing Earth System Grid for next generation climate model research project, a collaborative effort of GES DISC and NASA JPL, will bring temperature and humidity profiles from AIRS version 6. The AIRS version 6 product adds a new “TqJoint” data group, which contains data for a common set of observations across water vapor and temperature at all atmospheric levels and is suitable for climate process studies. How different may the monthly temperature and humidity profiles in “TqJoint” group be from the “Standard” group where temperature and water vapor are not always valid at the same time? This study aims to answer the question by comprehensively comparing the temperature and humidity profiles from the “TqJoint” group and the “Standard” group. The comparison includes mean differences at different levels globally and over land and ocean. We are also working on examining the sampling differences between the “TqJoint” and “Standard” group using MERRA data.

NextGen ESGF(Earth System Grid Federation)

The next generation ESGF will deliver a cyberinfrastructure to automatically precondition and publish NASA remote sensing datasets to the ESGF and its IPCC Assessment Report obs4MIPs activity. The cyberinfrastructure provides transparent access to ESGF models and facilitates their comparison with satellite data from JPL, LaRC and GSFC.

DATASET AND COMPARISON METHOD

AIRS Version 6 Level 3 Monthly Standard Retrieval Product Temperature and Humidity (water vapor mass mixing ratio) Daytime/Ascending and Nighttime/Descending Year 2003 to year 2013 (132 months)

850hPa, 700hPa, 600hPa, 500hPa, 400hPa, 300hPa

Mean Arithmetic Difference over Global/Land/Ocean :

$$\Sigma(\text{Standard} - \text{TqJoint}) / N$$

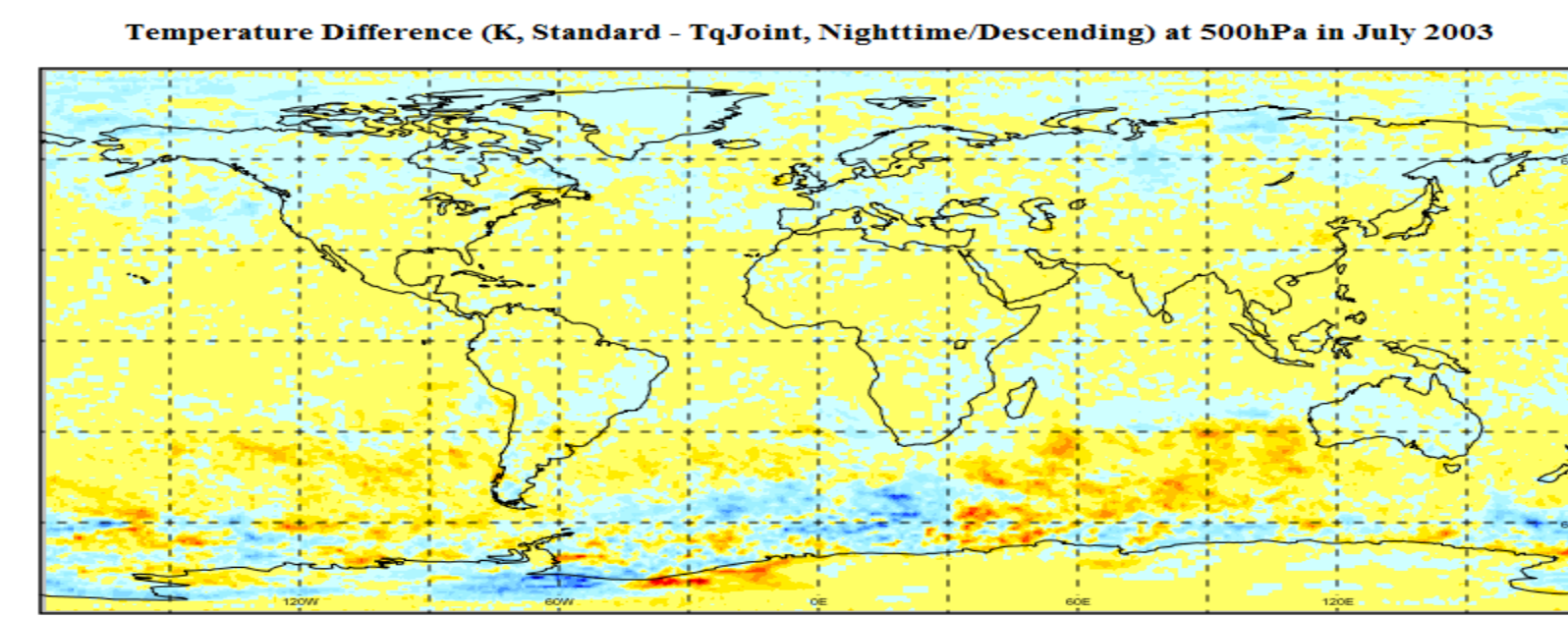
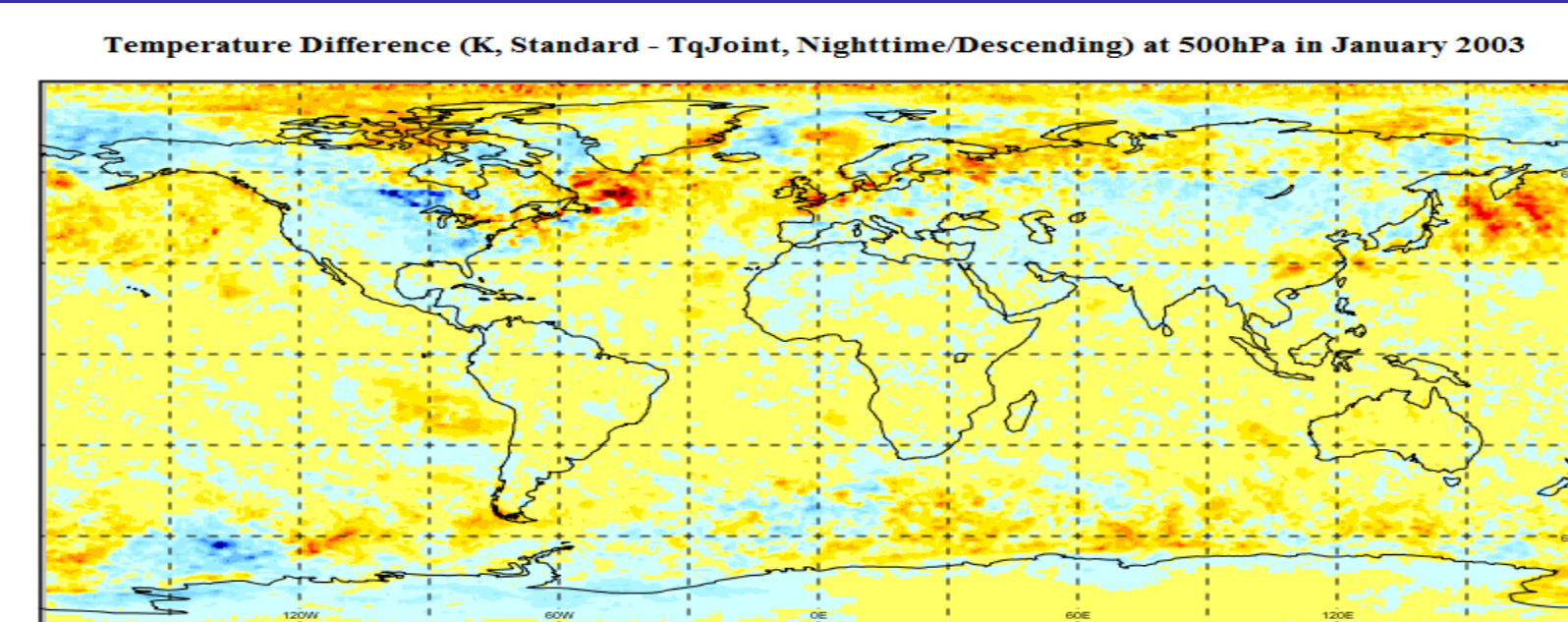
Difference of Global/Land/Ocean Mean(gridsize-weighted):

$$(\Sigma_{\text{standard}} / N_1)_{\text{gridsize-weighted}} - (\Sigma_{\text{TqJoint}} / N_2)_{\text{gridsize-weighted}}$$

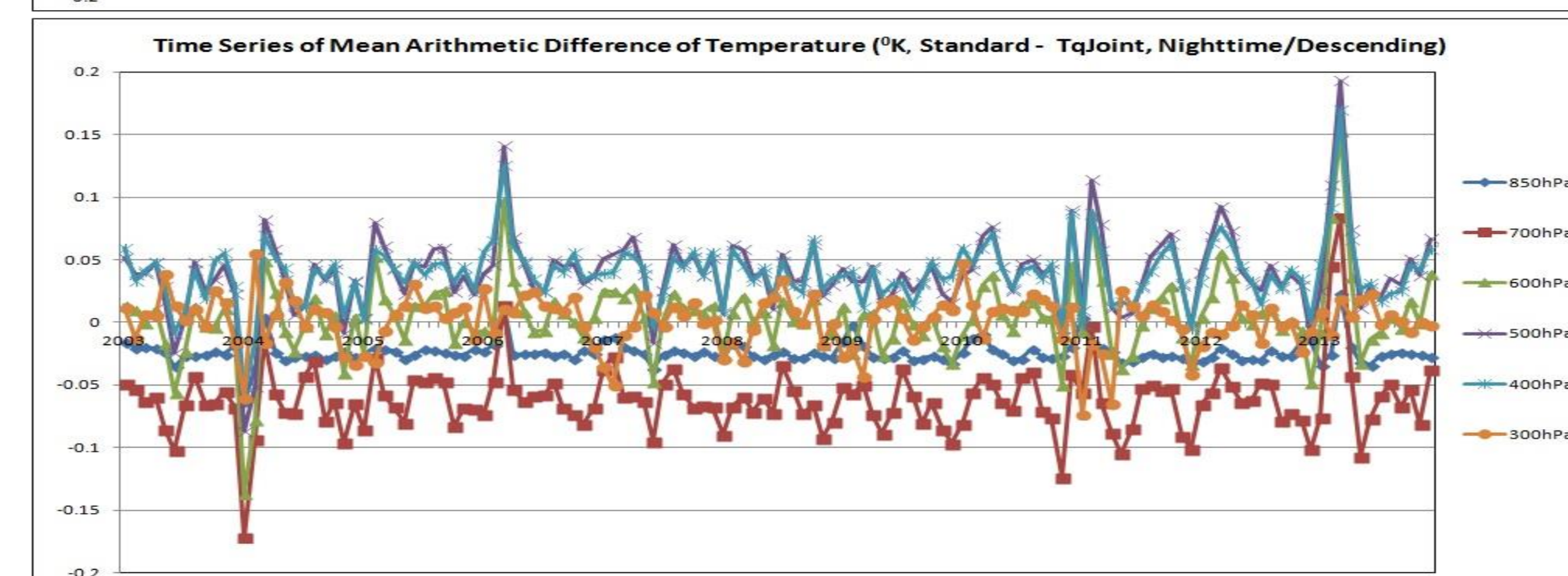
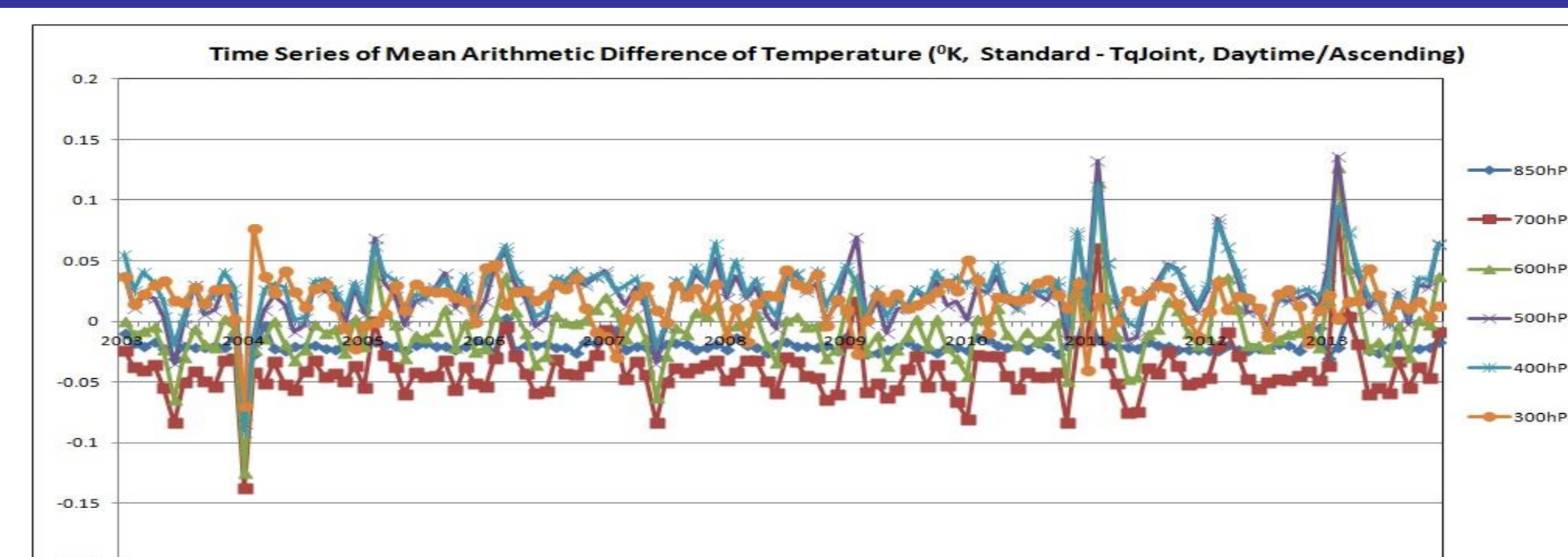
Daily Mean Difference:

$$(\text{Ascending Difference} + \text{Descending Difference}) / 2$$

TEMPERATURE

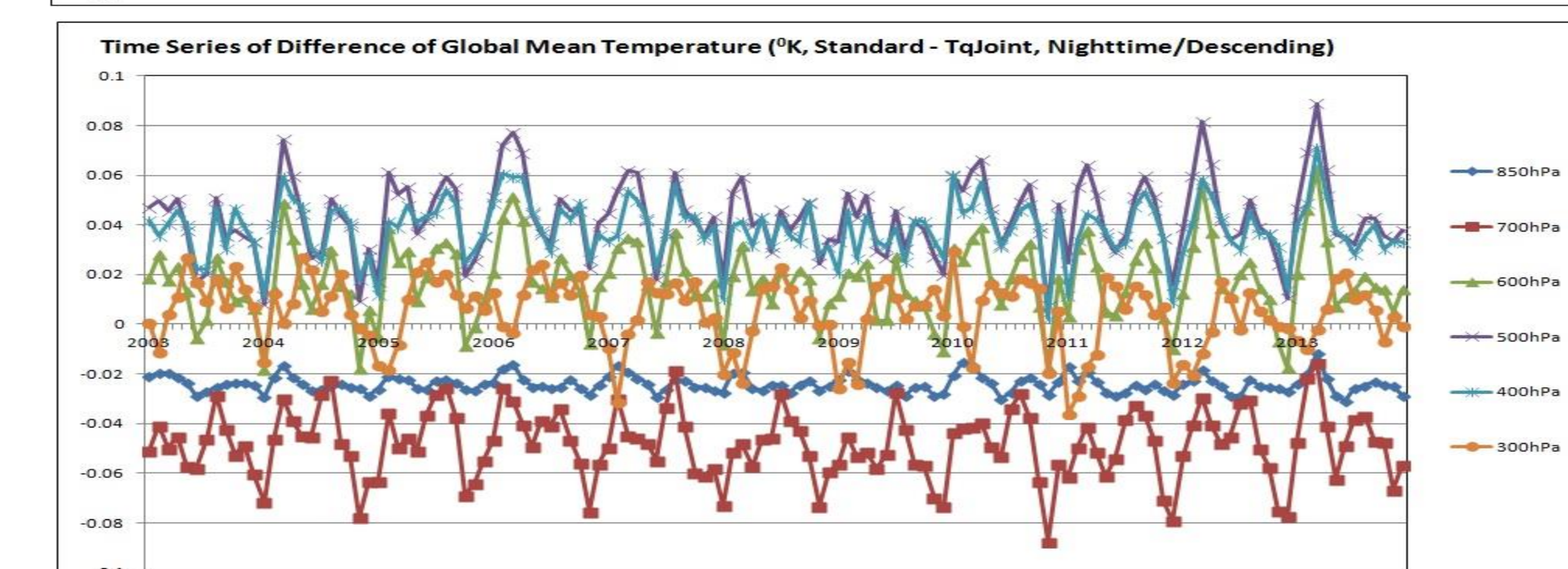
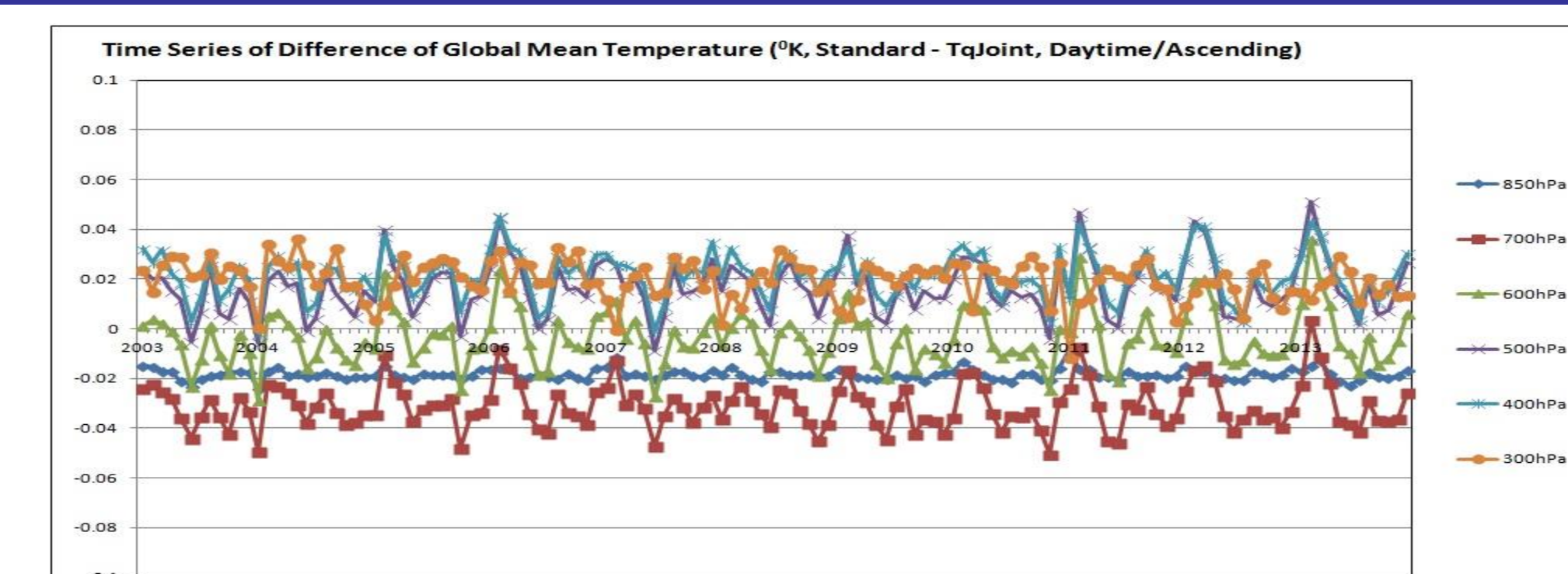


MEAN ARITHMETIC DIFFERENCE



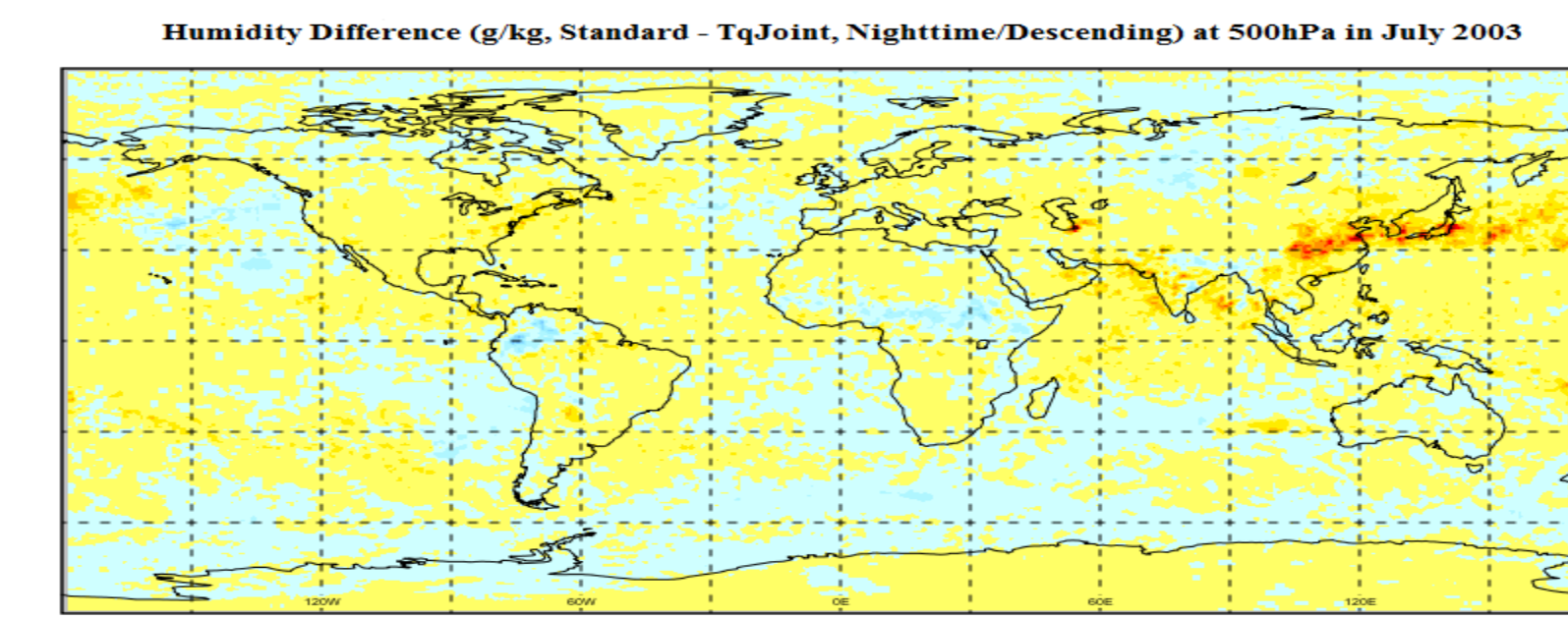
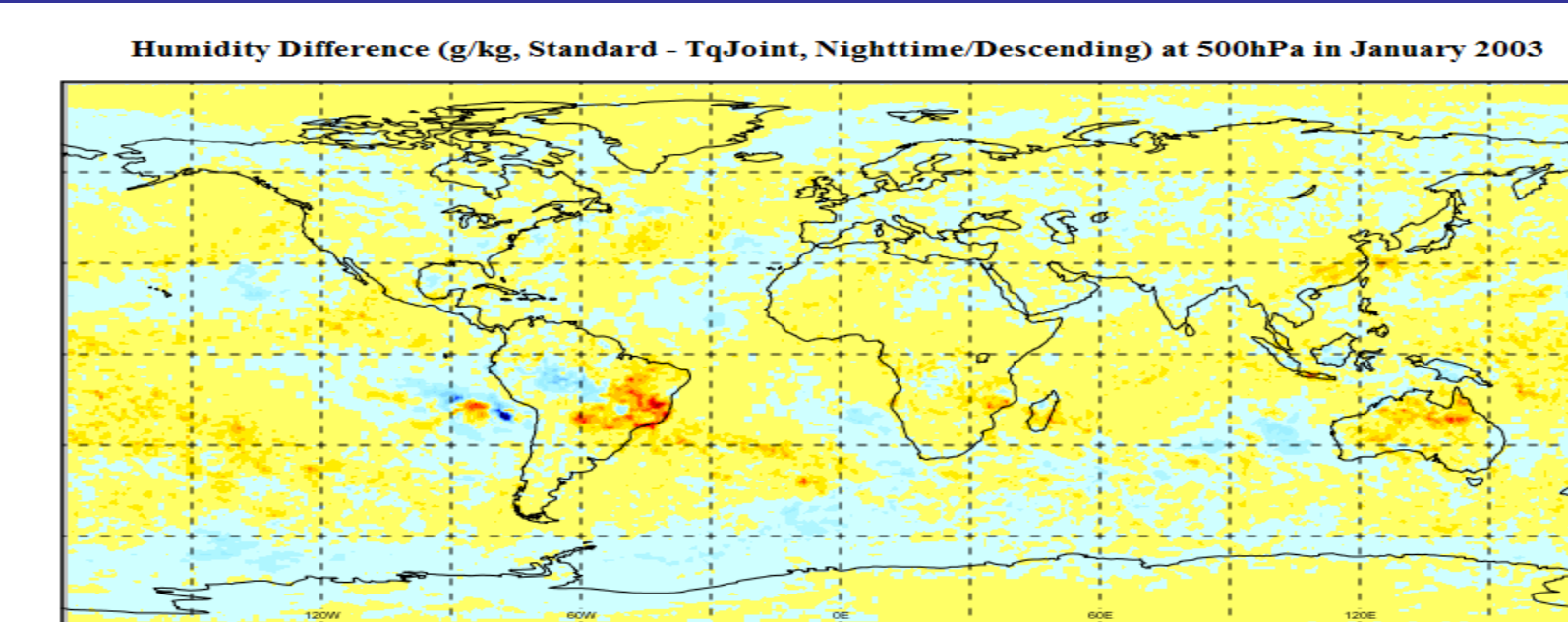
- Mean Arithmetic Difference: $\pm 0.2^\circ\text{K}$
850, 700hPa: Standard < TqJoint
600, 300hPa: Standard ~ TqJoint
500, 400hPa: Standard > TqJoint
- $\Delta_{\text{descending/nighttime}} > \Delta_{\text{ascending/daytime}}$

DIFFERENCE OF GLOBAL MEAN

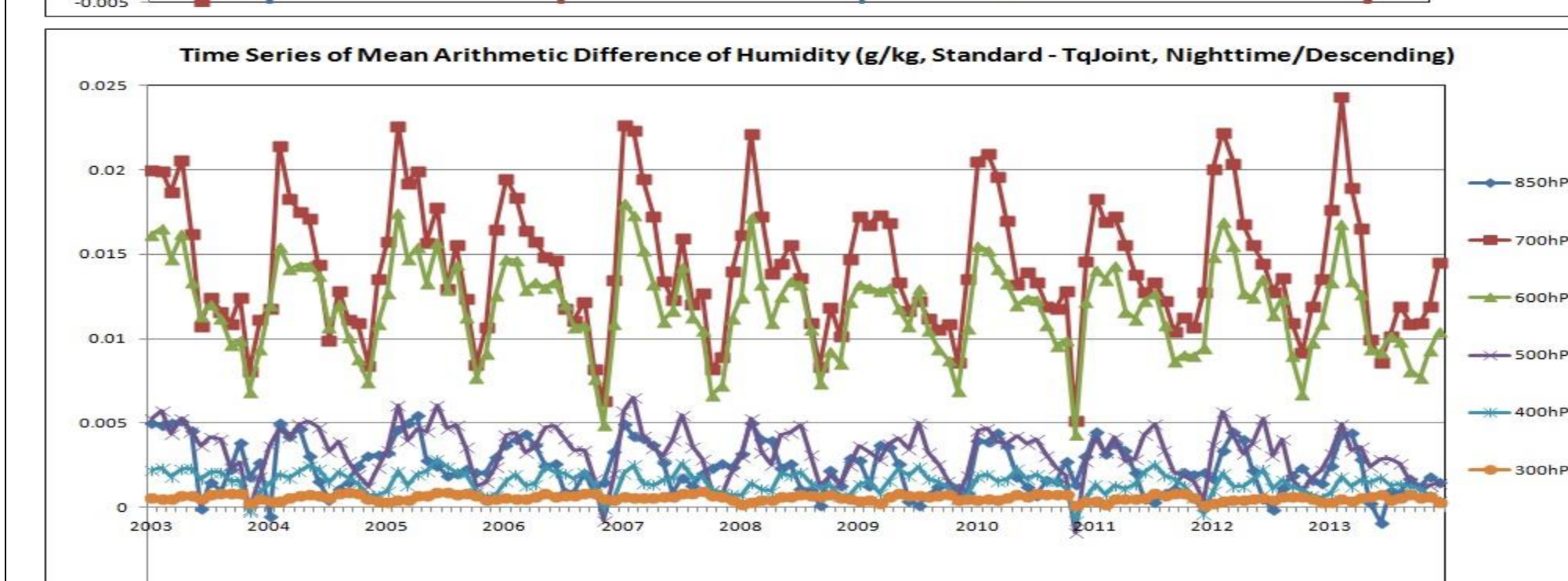
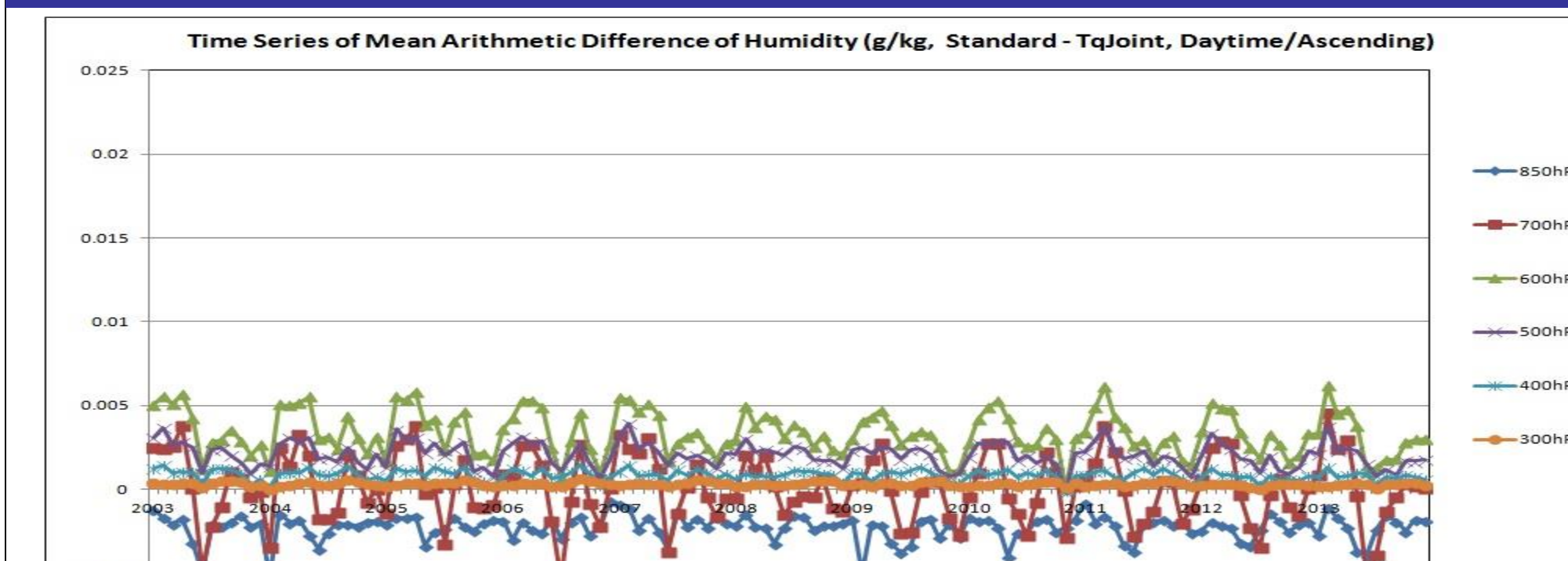


- Difference of Global Mean: $\pm 0.1^\circ\text{K}$
850, 700hPa: Standard < TqJoint
600, 500, 400, 300hPa: Standard > TqJoint
- $\Delta_{\text{descending/nighttime}} > \Delta_{\text{ascending/daytime}}$

HUMIDITY / WATER VAPOR MIXING RATIO

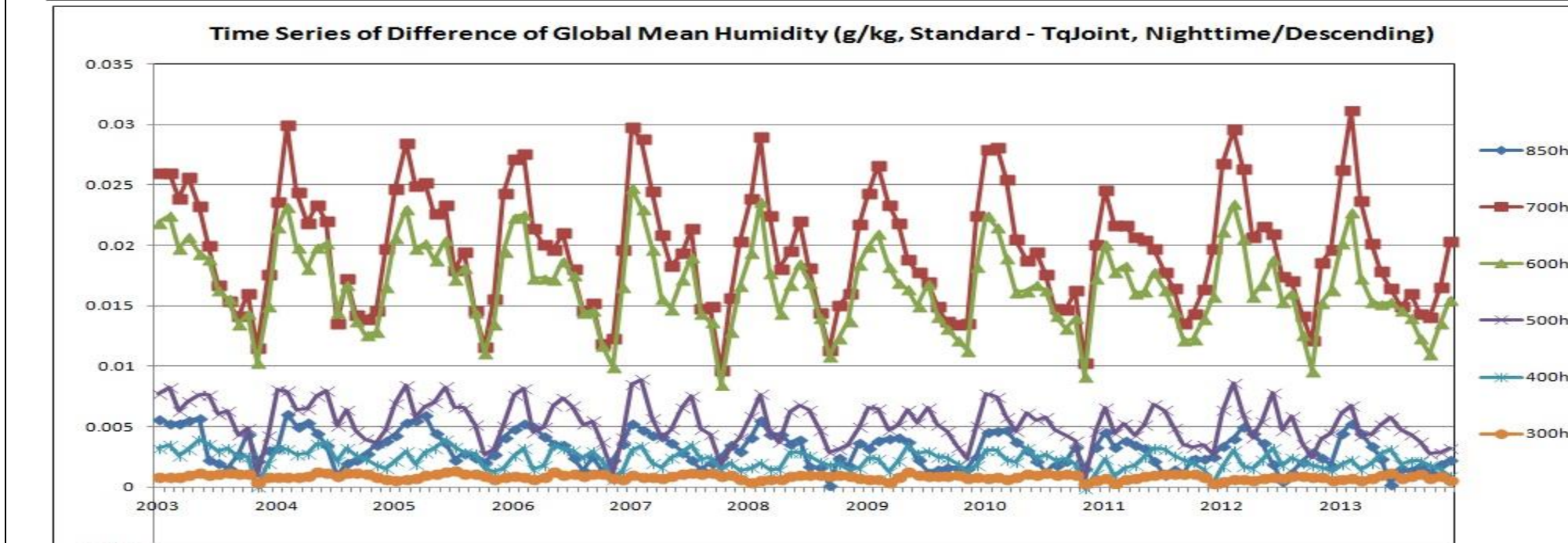
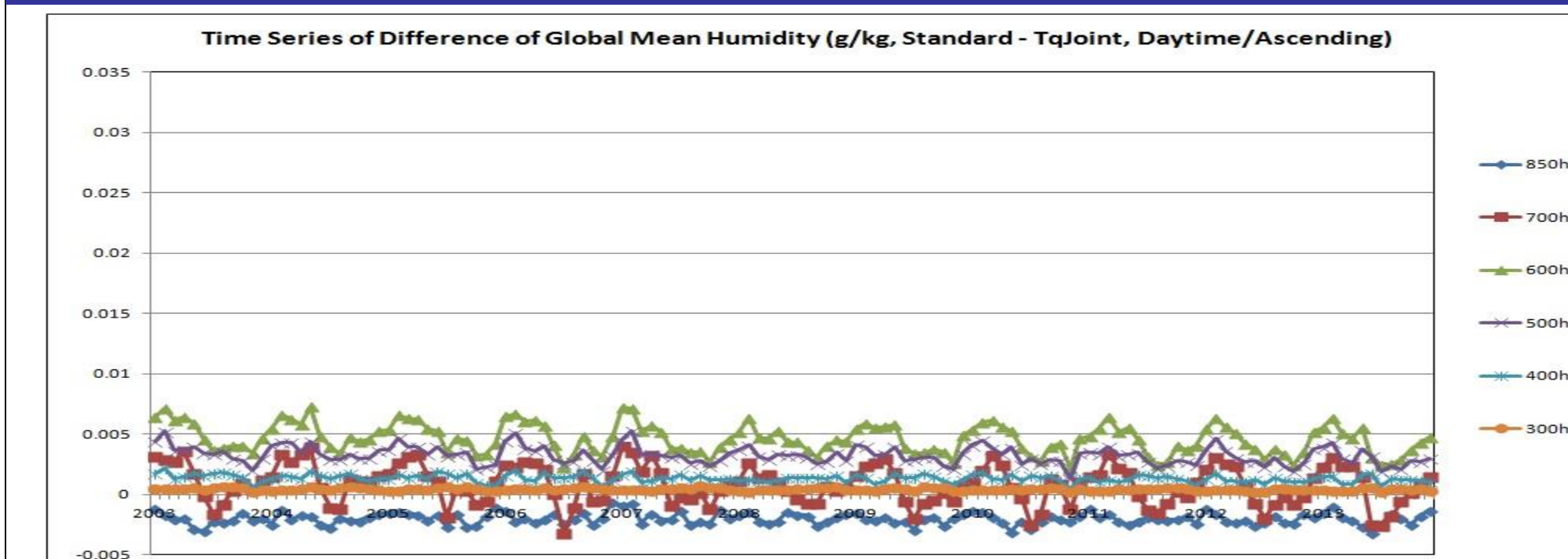


MEAN ARITHMETIC DIFFERENCE



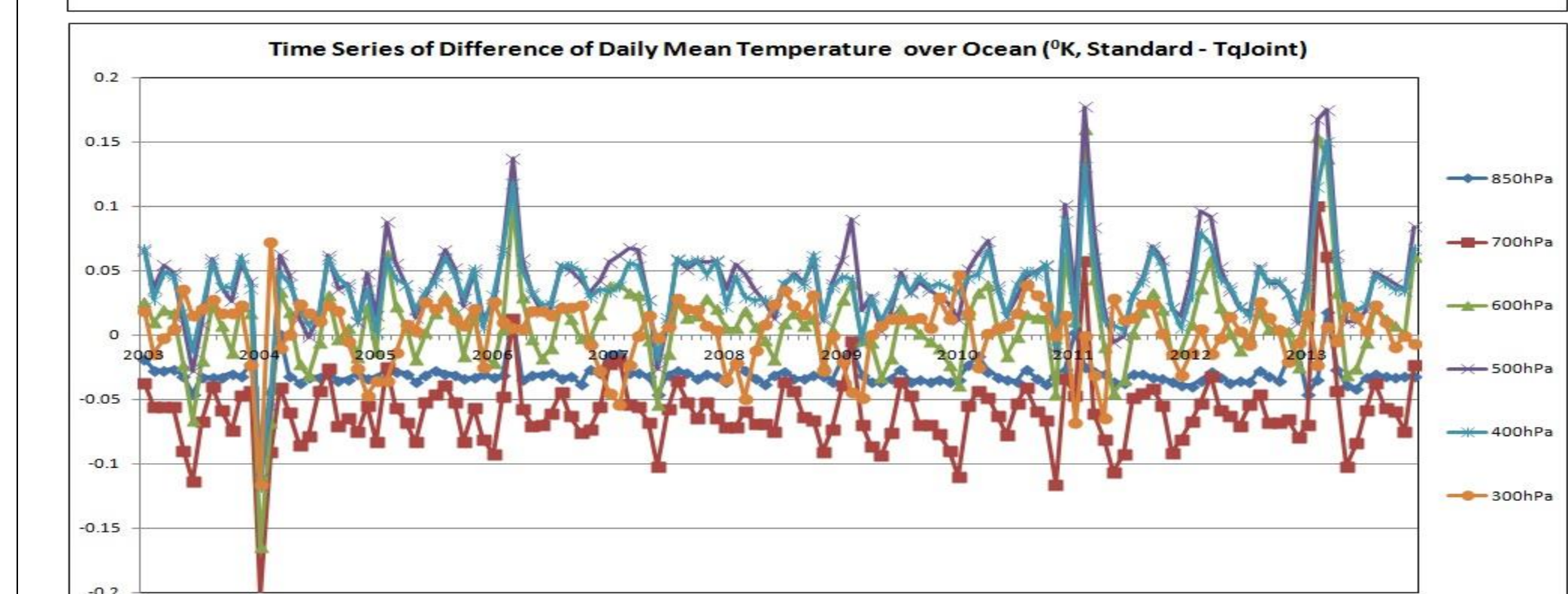
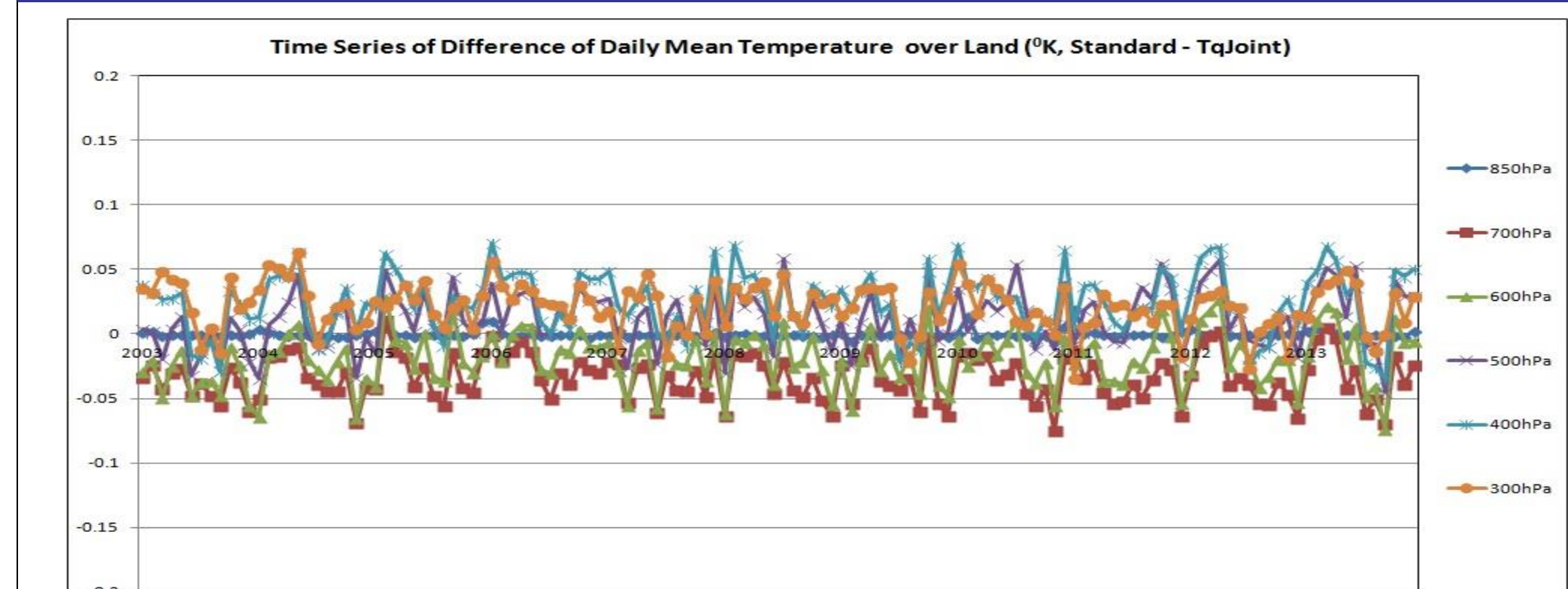
- Mean Arithmetic Difference: -0.005g/kg to +0.025g/kg
850hPa: Standard ~ TqJoint
700 to 300hPa: Standard > TqJoint
- $\Delta_{\text{descending/nighttime}} > \Delta_{\text{ascending/daytime}}$

DIFFERENCE OF GLOBAL MEAN

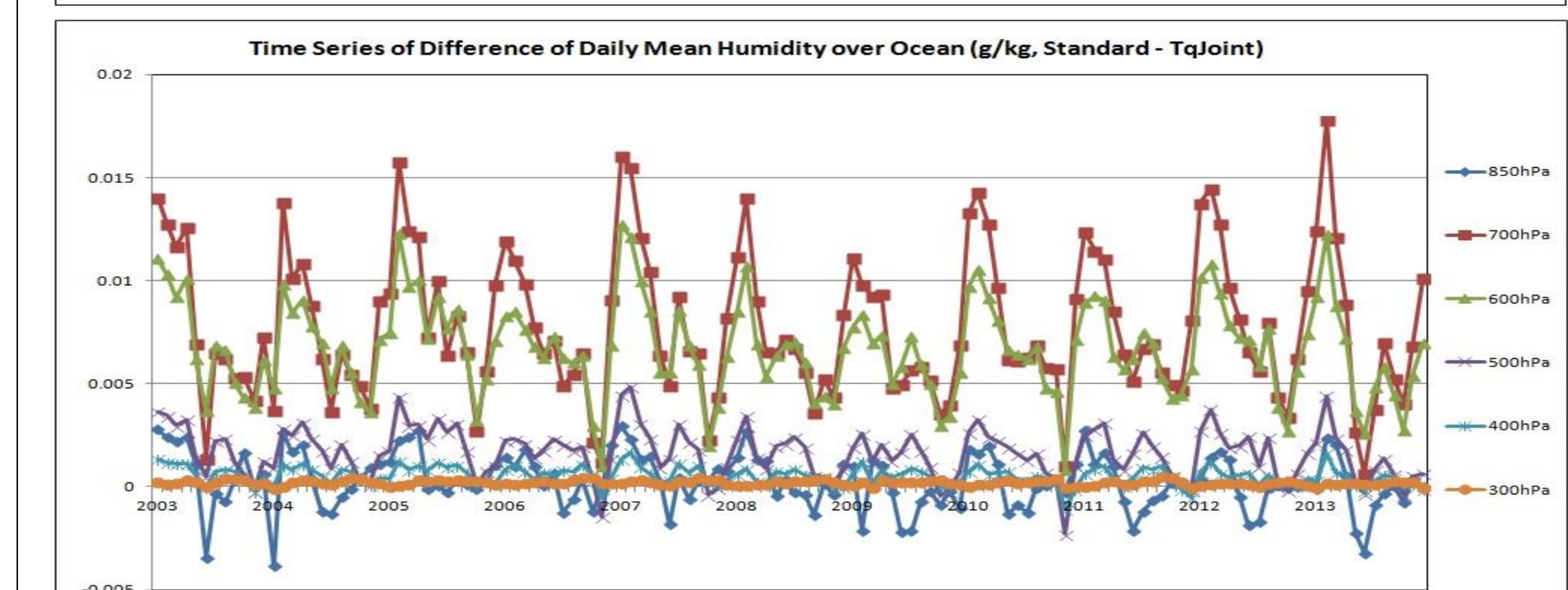
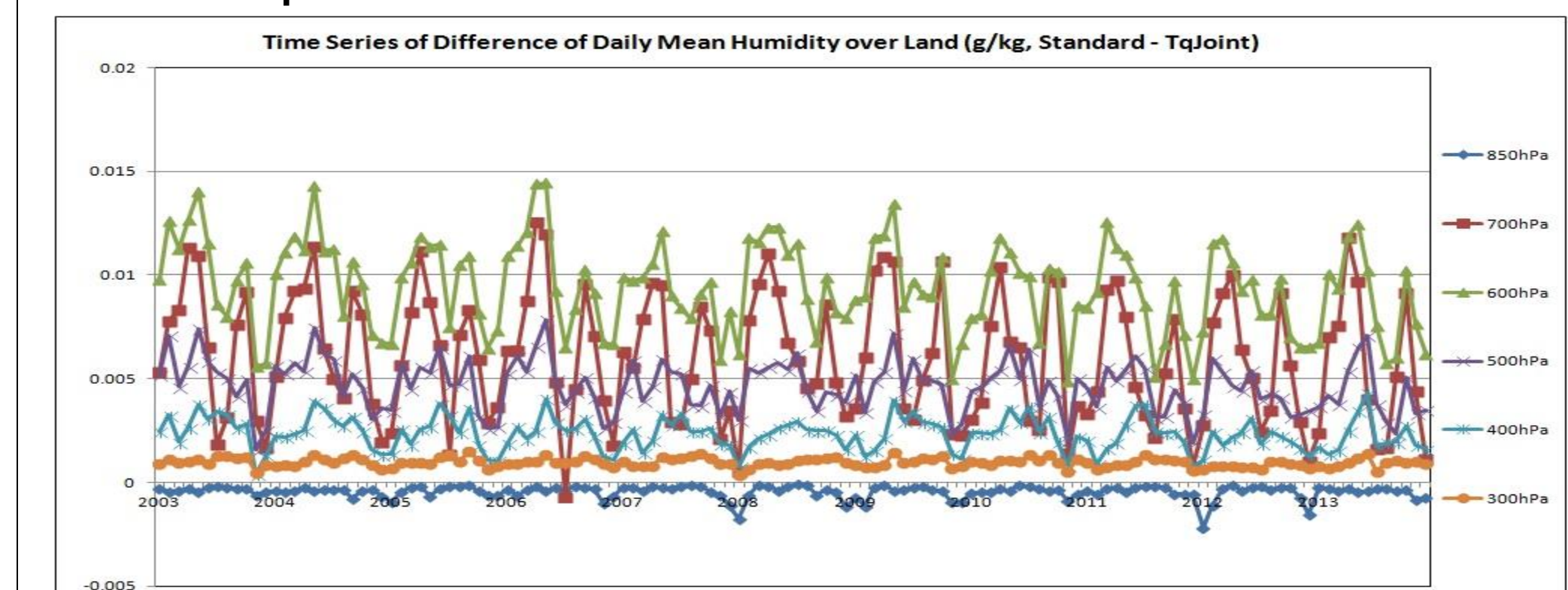


- Difference of Global Mean: -0.005g/kg to +0.035g/kg
850hPa: Standard ~ TqJoint
700 to 300hPa: Standard > TqJoint
- $\Delta_{\text{descending/nighttime}} > \Delta_{\text{ascending/daytime}}$

DIFFERENCES OVER LAND AND OCEAN



Consistent difference of temperature is shown at more pressure levels over ocean than over land.



Consistent difference of humidity is shown at more pressure levels over land than over ocean.

SUMMARY

- The differences of temperature and humidity between “TqJoint” and “Standard” data group in AIRS version 6 level 3 standard retrieval product are within a very narrow range.
- At most pressure levels, values of one data group are consistently greater or less than the other data group over land, over ocean, and globally.
- We are also working on examining the sampling differences between the “TqJoint” and “Standard” group using MERRA data.
- The AIRS version 6 monthly ascending and descending averaged temperature and humidity profiles from “TqJoint” data group will be available on ESGF for climate model study.

CONTACT INFORMATION

Feng Ding: feng.ding@nasa.gov